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# Increasing fabric perception accuracy of consumers in online fashion retailing

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153

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## Abstract

**Purpose** – This research examined how to present clothing fabrics online so that consumers gain an accurate impression. Providing online shoppers with accurate product information will lead to fewer product returns, offering clear economic and ecological benefits.

**Design/methodology/approach** – Two studies ( $N = 90$  and  $N = 379$ ) assessed the accuracy of fabric perception in different online presentation conditions. A base condition showing conventional information was compared to three conditions with additional information: scrunched fabric pictures; a video of a model wearing the dress or a video showing hands interacting with the fabric. ANOVA tests assessed the effect of the online condition on fabric perception discrepancies between the online-presented and actual dress.

**Findings** – A video in which hands interact with fabric, stretching, shaking, and crunching it, improved an accurate online fabric perception, specifically for stiffness and stretchability. A model video improved perception accuracy for glossiness. Scrunched fabric pictures improved accurate glossiness and thickness perception but worsened weight and stiffness perception for specific dresses.

**Practical implications** – These findings aid companies in making an informed decision on how to present fabrics with certain properties online in order to reduce product returns.

**Originality/value** – Existing research on the effect of different types of product presentation mainly focused on heightening purchase intention. We focused on increasing actual fabric perception accuracy, which will aid in adopting a more sustainable retail strategy by preventing unnecessary returns.

**Keywords** Online shopping, Online fashion retail, Online product presentation, Fabric perception

**Paper type** Research article

## 1. Introduction

In online shopping, it is often difficult for people to gain an accurate impression of a product, having to rely on the information presented by the retailer. Especially for so-called “experience products”, such as apparel, the lack of direct experience in an online environment creates uncertainty about product characteristics and performance (e.g. [Kim and Krishnan, 2015](#); [Weathers et al., 2007](#)).

Experience products have attributes that are difficult to describe and require seeing and touching ([Hong and Pavlou, 2014](#); [Rodrigues et al., 2017](#); [Van Kerrebroeck et al., 2017](#)). Therefore, products purchased online may differ from consumer expectations, resulting in dissatisfaction and increasing the likelihood that the product will be returned ([Hong and Pavlou, 2014](#); [Minnema et al., 2016](#)). Online returns have negative ecological and economic

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consequences, leading to costs for the retailer and being undesirable from a sustainability viewpoint (e.g. [Minnema et al., 2016](#); [Saarijarvi et al., 2017](#)). Reducing returns is an important challenge in online retailing ([Zhang et al., 2022](#)), especially for apparel ([de Leeuw et al., 2016](#)).

Particularly for experience goods, offering product-related information online reduces consumer uncertainty and decreases the return likelihood ([Hong and Pavlou, 2014](#); [Weathers et al., 2007](#)). Most studies on online apparel presentation focused on increasing purchase intent and sales. However, increasing online sales is not always desirable from an economic and ecological standpoint, as return behaviour should be taken into account ([El Kihal and Shehu, 2022](#)).

According to [Sobotta \(2019\)](#), twenty-three percent of product returns result from inaccurate depictions. Clear product information and the product meeting their expectations heighten consumers' online shopping satisfaction ([Dholakia and Zhao, 2010](#); [Duarte et al., 2018](#)). Accurate product information is thus beneficial for both companies and consumers and will prevent unnecessary fashion returns ([de Leeuw et al., 2016](#)). Although some studies on online fashion presentation included effects on perceived diagnosticity or uncertainty about products (e.g. [Kim and Krishnan, 2015](#); [Overmars and Poels, 2015](#)), research including measures of actual perception accuracy is scant.

Our research focuses on an accurate online communication of fabric. Fabric is an important purchase criterion for clothing, and people want fabric information when shopping for fashion online ([Boardman and McCormick, 2022](#); [Hsu and Burns, 2002](#)). Furthermore, the material not meeting customers' expectations is one of the main reasons for online fashion returns ([Saarijarvi et al., 2017](#)). Fabric properties relating to texture, hardness, temperature, and weight are especially difficult to communicate digitally, as their assessment requires touching (e.g. [Peck and Childers, 2003](#); [Rodrigues et al., 2017](#)). Knowledge on how to accurately convey such properties online is thus very relevant in order to reduce the high amount of clothing returns. Our research aims to provide fashion retailers and educators with knowledge on how different types of online presentation can improve fabric perception accuracy.

## 2. Communicating fabric properties online

Several researchers assessed how different types of pictures and videos affect fabric perception accuracy (e.g. [Jang and Ha, 2021](#); [Wijntjes et al., 2019](#); [Xiao et al., 2016](#)). Some looked at more advanced technical possibilities for presenting fabrics online, such as interactive videos or pictures, or touch-enabling technologies (e.g. [Orzechowski et al., 2011](#); [Overmars and Poels, 2015](#); [Van Kerrebroeck et al., 2017](#)). Although newer technologies such as VR and AR seem promising for reducing clothing fit concerns, for example, through virtual clothing try-ons (e.g. [Chen et al., 2022](#); [Baytar et al., 2020](#)), they are not yet suited for communicating fabric information. Fabric is difficult to render real-time in a digital environment (e.g. [Castillo et al., 2019](#)), and fabric touch and feel, comfort, and weight cannot be conveyed using AR ([Baytar et al., 2020](#)). Furthermore, smaller retailers have limited resources to implement such advanced solutions ([Bagatini et al., 2023](#)). Touch digitalization technology holds promise for the future, but currently, additional hardware is needed, which is not a sustainable model ([Ornati and Kalbaska, 2022](#)). Our research, therefore, focuses on online presentation formats that are easier to implement, increasing its practical relevance.

Most online clothing retailers offer front- and back-view pictures, and often a model picture and a zoomed-in fabric picture. Such pictures are found useful by consumers ([Boardman and McCormick, 2019](#)). Below, we identified additional picture and video types that may improve fabric perception accuracy.

### 2.1 Hypotheses

Pictures of draped, folded, or scrunched fabric seem promising to convey fabric information. Draped versus flat-lying fabric images helped participants correctly match the portrayed fabric to a physical fabric sample, being especially helpful in assessing glossiness and stiffness

(Xiao *et al.*, 2016). Furthermore, online shoppers used the shape, width, and number of fabric folds in pictures to evaluate the weight, thickness, stretchability, and stiffness of knitted sweaters (Jang and Ha, 2021). In addition, pictures of spiral-shaped creases and irregular folds were among the types of online fabric information preferred by fashion designers (Jang and Ha, 2023). Pictures of folded fabric may thus increase product understanding, reducing returns (Jang and Ha, 2021).

While clothing websites often offer a picture of flat-lying fabric, pictures of scrunched or folded fabric are less frequently used. It is relevant to know whether and how such pictures enhance accurate fabric perception.

*H1.* Supplemental scrunched fabric pictures improve fabric perception accuracy compared to conventional online clothing presentation.

Many clothing websites present model videos to show how the item fits on a body. Whether and how model videos could aid fabric perception accuracy is a relevant question. A video of a rotating model decreased participants' perceived evaluation difficulty for a dress (Jai *et al.*, 2021). Relatedly, rotating virtual models reduced perceived risk for apparel attributes, including texture (In Shim and Lee, 2011), and a model video increased participants' tactile sensations compared to pictures (Shaban *et al.*, 2024). Fabric property perception ratings were more accurate when participants saw a video versus pictures of a model (Xue *et al.*, 2016). Fabric moving and folding in a model video helped consumers evaluate its weight and thickness (Jang and Ha, 2021). Furthermore, motion improved the material surface shininess assessment compared to pictures (Doerschner *et al.*, 2011; Wendt *et al.*, 2010), which may also apply to fabric.

However, more information is not always better. Pictures including impression-based information, such as a beautiful model in a scenic context, may lead to unrealistically high product expectations, increasing product returns (De *et al.*, 2013). While consumers experienced pleasure and arousal in seeing an attractive model's face, they perceived more information when no face was presented with the product (Yoo and Kim, 2012). Similarly, an ordinary versus attractive-looking model heightened consumers' perceived amount of information (Liang *et al.*, 2022). A model video aimed at conveying accurate information should thus show only the model's body and have a neutral background. Furthermore, more brisk movements will be helpful in conveying fabric properties such as weight and thickness.

*H2.* A supplemental video of a moving model (with neutral background and only the body visible) improves fabric perception accuracy compared to conventional online clothing presentation.

Direct handling, such as stretching, grasping, and bending, is important for an accurate fabric perception (Xue *et al.*, 2016). Seeing fabric being moved may help communicate such aspects online, as observing an object being touched activates brain regions involved in tactile perception (e.g. Sun *et al.*, 2016). Movies of fabric swatches being moved performed better than images in conveying roughness and smoothness (Orzechowski *et al.*, 2011). Similarly, Wijntjes *et al.* (2019) found that such movies improve tactile fabric communication over pictures. They tested six movie styles, in which a piece of fabric, for example, was stretched over a foam shape that was then bent, or was wrinkled and released by two hands. Overall, movies outperformed pictures from these movies, but there was no difference in performance between movie styles. Wijntjes *et al.* (2019) also showed that watching someone else interact with fabric gave a rather good impression of its touch-related qualities. Indeed, videos showing hands stretching fabric or a hand moving fabric were among fashion designers' preferred types of online fabric information (Jang and Ha, 2023).

A video in which hands interact with the fabric, performing specific actions to reveal its properties—such as stretching, shaking, and squeezing (Wijntjes *et al.*, 2019)—will be especially suited to communicate fabric properties that can be conveyed by handling, such as stiffness, stretchability, thickness and weight (Jang and Ha, 2021; Soufflet *et al.*, 2004). And

as mentioned with H2, movement may help communicate glossiness (cf. Doerschner *et al.*, 2011; Wendt *et al.*, 2010). Furthermore, transparency can be conveyed by moving something behind the fabric.

H3. A supplemental video in which hands interact with the fabric improves fabric perception accuracy compared to conventional online clothing presentation.

Two experimental studies investigated these hypotheses and additionally assessed which specific fabric properties are better conveyed using the tested presentation methods. In Study 1, ninety females rated five dresses on several fabric properties in one of four online conditions and also while feeling the actual fabric. The ratings in the online conditions were compared to the actual fabric ratings. In Study 2, an online sample of 379 females evaluated the same dresses on the five most difficult-to-evaluate properties from Study 1 in one of the four online conditions. Ratings were compared to the mean actual fabric ratings from Study 1. The studies and their findings are described below.

### 3. Study 1

#### 3.1 Method

Four online presentation conditions were tested in an experiment [1] in which participants evaluated five dresses on several fabric properties. The base condition showed product information usually presented on clothing websites. This same information was included in the other conditions, which either showed additional pictures or a brief video. The perception accuracy in those conditions was compared with the base condition to test the hypotheses. The conditions are described below (Appendix 1 in the Supplementary file shows the pictures and some video stills for one dress for reference purposes).

- (1) Base condition— a brief description of the dress with pictures of a model wearing it, the zoomed-in dress on the model, front and back views without a model, and the zoomed-in flat-lying fabric.
- (2) Scrunched pictures condition— base condition plus zoomed-in pictures of the scrunched fabric.
- (3) Model video condition— base condition plus a video of a moving model (with a white background, showing only the body).
- (4) Hands-interaction video condition— base condition plus a video in which hands interact with the fabric, shaking, squeezing, and stretching the dress.

*3.1.1 Stimuli.* The Dutch online retailer Wehkamp provided us with eleven dresses that were relatively often returned, and for which the fabric being different from expectations was a probable reason. From these, we selected five that differed in fabric properties and for which we expected the most difficulties in gaining an accurate fabric perception online. Dress A is rather thick and heavy, stretchable, and relatively soft. Dress B's Lyocell fabric looks like denim but is softer, thinner, smoother, and more limp. Dress C is rather thin and limp and a bit glossy; although it has a woven-in pattern, it still feels rather smooth and soft. Dress D is black, making the fabric more difficult to see online, and is a bit glossy, stretchable, soft, limp, and probably thinner than expected. Dress E is relatively stiff and has woven-in stripes, but is still rather soft (see Figure 1).

*3.1.2 Participants.* To ensure some relevance of the category (dresses) and some experience in online fashion shopping, we selected females who bought clothing online at least five times in the last year. A convenience sample of 90 university Master's (and a few recently graduated) students, aged between 19 and 33 ( $M = 24.4$ ), participated.



**Figure 1.** The five dresses. Source: Wehkamp Retail Group B.V. (printed with permission)

**3.1.3 Procedure.** Participants performed the study on a laptop while seated at a table in a university hall with the experimenter present. They started with the base condition and evaluated a different dress in each condition (randomly assigned to a systematically varied order, with 18 participants in each dress-online presentation condition combination [2]).

For each dress, the participant saw an online presentation similar to a clothing retail website. She rated several fabric properties on scales from 0 to 10, with poles describing the opposites (e.g. limp-stiff). Next, the participant was given the actual dress and rated the fabric properties again while seeing and feeling the fabric. She then indicated how well her perception based on the online presentation matched the actual fabric (the “*perceived matching degree*”, ranging from 0 “not match” to 10 “perfect match”). This procedure was repeated for all five dresses/conditions (see [1]), taking about one hour.

**3.1.4 Measures.** We included fabric properties mentioned in several studies or explicitly found relevant for clothing (see Fleming *et al.*, 2013; Grineviciute *et al.*, 2005; Jang and Ha, 2021; Soufflet *et al.*, 2004). These were thickness (thin-thick), weight (light-heavy), glossiness (dull-shiny), transparency (not transparent-transparent), stiffness (limp-stiff), stretchability (not stretchable-very stretchable), roughness (smooth-rough), softness (harsh-soft), coldness of touching (warm-cold), and fragility (strong-fragile) [3]. Following Fleming *et al.* (2013), we included brief property descriptions, as an insufficient understanding of the fabric properties can lead to assessment differences (Grineviciute *et al.*, 2005).

Three dependent variables were used. The “*perceived matching degree*” is explained in section 3.1.3. The “*property perception discrepancy*” indicates the absolute difference between a fabric property rating based on online presentation and the actual dress, ideally small. The “*mean perception discrepancy*” is the average of these property perception discrepancies for each dress-condition combination, indicating the extent to which the online condition conveyed an accurate overall fabric impression.

### 3.2 Results

Some participants correlated very low (below 0.20) in inter-rater reliability tests for the real fabric property ratings and were excluded from the analyses ( $n = 18$ ), slightly improving the online-real fabric rating discrepancies.

Participants were presented with all dresses and conditions but saw each dress in only one condition (receiving five of the 25 dress-condition combinations). We first conducted repeated measures ANOVAs over dresses (81–88 participants per condition). As the condition effect may differ per dress (differing in fabric properties), we subsequently analysed the data per dress with the condition as a between-subject factor (14–18 participants per condition).

The mean “*perceived matching degree*” values per condition were respectively 5.39, 5.13, 5.52, and 6.09 (higher is better), but there were no significant differences from the base condition overall (ANOVA,  $F(3, 228) = 2.33, p = 0.08$ ), nor for specific dresses. However, this measure correlated significantly with the “*mean perception discrepancy*” ( $\rho = -0.48$ ,

$p < 0.001$ ); a lower perceived match between the online presented and real fabric related to a higher mean online-real property rating discrepancy, underscoring the relevance of the included fabric properties.

**3.2.1 Mean perception discrepancy.** Although the mean perception discrepancy was lower/better in the video conditions, repeated measures ANOVA results showed no significance of condition ( $M_{\text{discr}} = 2.05, 2.03, 1.95, 1.78$ ;  $F(3, 228) = 1.78, p = 0.15$ ). One-way ANOVA results per dress showed a significant condition effect for dress B ( $F(3, 67) = 3.19, p = 0.03, \eta^2 = 0.13$ ) and E (Brown-Forsythe  $F(3, 46) = 2.82, p = 0.05, \eta^2 = 0.12$ ) (Figure 2 in the Supplementary file shows the mean perception discrepancies for reference purposes). Post-hoc comparisons with the base condition showed that the hands-interaction video increased fabric perception accuracy for dress E ( $M_{\text{discr}} = 1.89$  vs  $1.32$ ; Dunnett test:  $M_{\text{diff}} = -0.56, CI_{95\%} = [-1.11, -0.02], p = 0.04$ ), supporting H3, but showed no significant results for dress B.

**3.2.2 Property perception discrepancies.** Table 1 shows the mean discrepancies between property ratings based on online presentation (averaged over conditions) and the actual fabric, indicating the relative difficulty in perceiving these properties online. This aids in interpreting results, as the base condition may suffice for dresses and properties that are easy to perceive.

Repeated measures ANOVA results per fabric property showed no overall significant effects for the condition factor. One-way ANOVA results per dress showed some significant effects for dresses B, C, and E.

For dress B, the perception discrepancy for fabric *weight* ( $F(3, 67) = 3.76, p = 0.02, \eta^2 = 0.15$ ) and *stiffness* ( $F(3, 67) = 3.18, p = 0.03, \eta^2 = 0.13$ ) varied significantly with the online condition. For *weight*, scrunched fabric pictures performed worse than the base condition (Dunnett test:  $M_{\text{discr}} = 4.00$  vs  $2.06, M_{\text{diff}} = 1.94, CI_{95\%} = [0.23, 3.65], p = 0.02$ ), as the denim-like Lyocell fabric was perceived as heavier ( $M_{\text{weight}} = 6.76$ , base condition  $5.22$ , real fabric  $3.26$ ). For *stiffness*, there were no significant differences from the base condition.

For dress C, the perception discrepancy varied with condition for *thickness* ( $F(3, 69) = 3.08, p = 0.03, \eta^2 = 0.12$ ) and *glossiness* (Brown-Forsythe  $F(3, 47) = 3.82, p = 0.02, \eta^2 = 0.15$ ). For *thickness*, there were no significant differences from the base condition. For *glossiness*, the online-real perception discrepancy was lower than the base condition ( $M_{\text{discr}} = 2.29$ ) for both scrunched pictures ( $M_{\text{discr}} = 0.72$ ) and a model video ( $M_{\text{discr}} = 1.12$ ) (Dunnett tests,  $M_{\text{diff}}$  condition 2 vs 1 =  $-1.57, CI_{95\%} = [-2.72, -0.43], p = 0.004$ ;  $M_{\text{diff}}$  condition 3 vs 1 =  $-1.18, CI_{95\%} = [-2.34, -0.01], p = 0.05$ ). Dress C seemed less glossy in

**Table 1.** Average fabric property discrepancies in study 1

Discrepancy	Dress A	Dress B	Dress C	Dress D	Dress E	Overall
D_Stretchability	1.99	2.21	3.04	2.61	1.36	2.25
D_Softness	1.94	3.09	2.07	2.06	1.95	2.22
D_Roughness	1.94	2.69	2.06	2.30	1.86	2.17
D_Stiffness	2.25	3.62	1.29	1.30	2.14	2.12
D_Thickness	2.12	2.87	1.34	2.24	1.82	2.08
D_Weight	2.04	2.56	1.36	2.15	1.70	1.96
D_Fragility	2.15	1.94	1.76	2.15	1.39	1.88
D_Transparency	1.24	2.12	1.53	2.30	1.70	1.77
D_Glossiness	1.78	1.41	1.37	1.94	1.82	1.66
D_Coldness	1.35	1.93	1.49	2.06	1.35	1.63
Mean discrepancy	1.88	2.44	1.73	2.11	1.71	

**Note(s):** Properties are ordered on overall perception discrepancy (right column). For easy overview, perception discrepancies (absolute value) bigger than 2.00 are italicized

**Source(s):** Authors' own work

the base condition ( $M = 5.35$ ) than scrunched picture and model video conditions ( $M = 6.89$  and  $6.61$ ; real fabric  $6.47$ ).

For dress E, the *thickness* rating discrepancy varied with condition ( $F(3, 65) = 2.95$ ,  $p = 0.04$ ,  $\eta^2 = 0.13$ ). Adding scrunched fabric pictures performed better than the base condition (Dunnett test:  $M_{\text{discr}} = 1.06$  vs  $2.31$ ,  $M_{\text{diff}} = -1.25$ ,  $CI_{95\%} = [-2.37, -0.13]$ ,  $p = 0.03$ ), in which the fabric looked too thick ( $M = 5.06$ , scrunched pictures  $3.88$ , real fabric  $3.83$ ).

### 3.3 Conclusion and discussion

Supplemental scrunched fabric pictures improved the perception accuracy of dress C's glossiness, agreeing with [Xiao et al. \(2016\)](#), and dress E's thickness, agreeing with [Jang and Ha \(2021\)](#). However, they decreased an accurate weight perception for dress B, contradicting [Jang and Ha's \(2021\)](#) findings for knitted sweaters. [H1](#) is thus supported for glossiness and thickness but rejected for fabric weight.

A model video helped correctly perceive dress C's glossiness, providing some support for [H2](#). A supplemental hands-interaction video improved dress E's overall fabric perception accuracy, supporting [H3](#).

This study had some limitations. The task may have been tiresome, as for each dress, participants rated 11 fabric properties twice (for online presented and actual fabric). As dress/condition order was varied, this had no systematic influence but may have reduced effects. Also, the number of participants per dress in each condition was relatively small. Furthermore, several participants proposed improvements to the hands-interaction videos. We, therefore, conducted a second study.

## 4. Study 2

Study 2 used the same dresses and conditions as Study 1. A mixed experimental research design was used, with condition as a between-subjects factor and dress as a within-subjects factor. As the real fabrics were already rated in Study 1, Study 2 was performed online, allowing for a bigger, more heterogeneous (nonstudent) sample. Furthermore, the number of fabric properties was reduced to the five that were most difficult to perceive online in Study 1 (see [Table 1](#)).

### 4.1 Method

**4.1.1 Stimuli and participants.** The Study 1 stimuli were used, except for improved hands-interaction videos. Some changes were using a hanger for moving the dress, slower stretching and scrunching movements, and a white background ([Appendix 1](#) in the [Supplementary file](#) shows some video stills for reference purposes).

Data were gathered on the MTurk platform among females older than 18 in the UK ( $n = 31$ ) and the US. As they should have some experience in buying clothing online, we removed 14 participants who had never bought clothing online. Nineteen percent of the remaining participants bought clothing online more than ten times a year. This was six to ten times for 25.9% and one to five times for 43.3%, while 11.9% bought clothing online less than once a year. Their education level varied from primary school to a doctorate, and their age ranged from 22 to 73 ( $M = 41.5$ ), not differing significantly between conditions ( $F(3, 378) = 1.97$ ,  $p = 0.12$ ).

**4.1.2 Procedure.** Participants were randomly assigned to one condition, with dresses presented in random order. Video condition participants had to report a screen colour edited at the end to ensure they watched it completely. The survey took about eight minutes to complete.

The questionnaire first briefly explained the five fabric properties, which participants then rated for each dress on nine-point scales with poles describing the opposites. At the end, they reported their online clothing purchase frequency, age, education level, and gender. Participants received a small monetary reward.

**4.1.3 Measures.** Dependent variables were the absolute difference between the online presented and real fabric ratings for each property (“*property perception discrepancies*”) and the average property perception discrepancy (“*mean perception discrepancy*”) per dress per participant, as in Study 1. The real fabric ratings were the average property scores for the actual fabric from Study 1. The interrater reliability of these ratings for each dress was very high (ICC based on a mean-rating ( $k = 90$ ), absolute-agreement, 2-way mixed-effects model was between 0.96 and 0.99). Participants whose ratings correlated very low with others were removed (see Study 1), and the real fabric ratings were based on 77 raters.

#### 4.2 Results

Mixed ANOVAs were conducted with “presentation condition” as a between- and “dress” as a within-subjects factor [4]. Hypotheses were tested by comparing the fabric perception accuracy in each condition with the base condition.

**4.2.1 Mean perception discrepancy.** The effects of condition ( $F(3, 375) = 6.06, p = 0.001, \eta_p^2 = 0.05$ ) and dress ( $F(3.83, 1436.14) = 136.71, p < 0.001, \eta_p^2 = 0.27$ ) were significant, and their interaction effect not ( $F(11.49, 1436.14) = 1.38, p = 0.17$ ). Dunnett test results showed no significant differences from the base condition, although there was a statistical trend for the hands-interaction condition ( $M_{discr} = 1.68$  vs  $1.83$ ;  $M_{diff} = -0.14, CI_{90\%} = [-0.28, -0.01]$ ,  $p = 0.06$ ) (Figure 3 in the Supplementary file shows the mean perception discrepancies for reference purposes).

**4.2.2 Property perception discrepancies.** For each fabric property, a mixed ANOVA was used to test differences in perception discrepancy with condition and dress. Table 2 shows the mean perception discrepancy scores. These are slightly lower than in Table 1, as Study 2 used ratings from 1–9 instead of 0–10.

For *thickness*, a significant effect was found for condition ( $F(3, 375) = 4.23, p = 0.006, \eta_p^2 = 0.03$ ) and dress ( $F(3.3, 1231.76) = 126.08, p < 0.001, \eta_p^2 = 0.25$ ), while their interaction was not significant ( $F(9.85, 1231.76) = 1.36, p = 0.20$ ). There were no significant differences with the base condition (Figure 4 in the Supplementary file shows the mean perception discrepancies for reference purposes).

For *stiffness*, the effects of condition ( $F(3, 375) = 4.42, p = 0.005, \eta_p^2 = 0.03$ ) and dress ( $F(3.62, 1359.04) = 129.47, p < 0.001, \eta_p^2 = 0.26$ ) were significant. The hands-interaction video led to a more accurate stiffness perception than the base condition (Dunnett test:  $M_{discr} = 1.70$  vs  $1.94$ ;  $M_{diff} = -0.25, CI_{95\%} = [-0.49, -0.002]$ ,  $p = 0.05$ ) (Figure 5 in the Supplementary file shows the mean perception discrepancies for reference purposes). The condition-dress interaction effect was also significant ( $F(10.87, 1359.04) = 3.17, p < 0.001, \eta_p^2 = 0.03$ ) (see Figure 6 in the Supplementary file for reference purposes). There were condition effects for

**Table 2.** Average fabric property discrepancies in study 2

Difference on property	Dress A	Dress B	Dress C	Dress D	Dress E	Overall
D_Thickness	2.46	3.06	1.41	1.35	1.66	1.99
D_Stiffness	2.07	3.15	1.44	1.25	1.67	1.91
D_Softness	1.50	2.87	1.79	1.54	1.45	1.83
D_Roughness	1.76	1.97	1.65	1.70	1.64	1.74
D_Stretchability	1.79	1.55	2.30	1.52	1.36	1.70
Mean discrepancy	1.91	2.52	1.72	1.47	1.55	

**Note(s):** Properties are ordered on overall perception discrepancy (right column). For easy overview, discrepancies bigger than 1.60 are italicized (being comparable to Table 1 discrepancies bigger than 2.00 on an 11-point scale)

**Source(s):** Authors' own work

dress A and B, whose stiffness discrepancies were indeed higher than for other dresses. Pairwise comparisons (Bonferroni adjusted) showed that for dress A, adding scrunched pictures performed worse than the base condition ( $M_{\text{discr}} = 2.34$  vs.  $1.90$ ;  $M_{\text{diff}} = -0.44$ ,  $CI_{95\%} = [-0.84, -0.05]$ ,  $p = 0.02$ ), as the fabric was perceived as too limp ( $M_{\text{stiffness}} = 2.60$ , actual dress 4.48), rejecting H1. For dress B, a supplemental hands-interaction video increased stiffness perception accuracy ( $M_{\text{discr}} = 2.48$  vs  $3.50$ ;  $M_{\text{diff}} = 1.02$ ,  $CI_{95\%} = [-1.69, -0.37]$ ,  $p < 0.001$ ); the fabric seemed too stiff online, but less so with a hands video ( $M = 4.76$ ; base condition 6.21; real fabric 2.78), supporting H3.

The *stretchability* discrepancies differed significantly with condition ( $F(3, 375) = 5.49$ ,  $p = 0.001$ ,  $\eta_p^2 = 0.04$ ) and dress ( $F(3.66, 1374.14) = 30.07$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.07$ ), but there were no significant differences with the base condition (see Figure 7 in the Supplementary file for reference purposes). The interaction effect was significant ( $F(10.99, 1374.14) = 3.16$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.03$ ); a condition effect was found for dress C, with indeed the highest stretchability discrepancies (see Figure 8 in the Supplementary file for reference purposes). The hands-interaction condition performed better than the base condition for dress C ( $M_{\text{discr}} = 1.64$  vs  $2.57$ ;  $M_{\text{diff}} = -0.93$ ,  $CI_{95\%} = [-1.55, -0.31]$ ,  $p < 0.001$ ), supporting H3 ( $M_{\text{stretchability}} = 3.14$ , base condition 4.92, real fabric 2.83).

For *roughness* and *softness*, a significant effect was found for dress, but not for condition and their interaction.

#### 4.3 Conclusion and discussion

A supplemental hands-interaction video tended to improve overall fabric perception accuracy and improved overall fabric stiffness perception compared to the base condition, supporting H3. The hands-interaction video also improved the perception of stiffness and stretchability for the dresses for which those properties were most difficult to assess. When properties are difficult to assess, there is more opportunity for improving perception accuracy. We thus conclude that a video in which hands interact with fabric improves the perception accuracy of stiffness and stretchability, supporting H3. However, the beneficial effects for thickness and roughness, expected based on Jang and Ha (2021) and Orzechowski *et al.* (2011), were not found.

Scrunched fabric pictures did not improve the perception of any properties, even worsening stiffness perception for dress A, and H1 is rejected. This shows that more information is not always better. Furthermore, the model video had no beneficial effects compared to the base condition, and H2 is rejected.

### 5. General discussion

Especially in apparel retailing, online returns are a key problem, leading to high costs for retailers (El Kihal and Shehu, 2022; Minnema *et al.*, 2016; Saarijarvi *et al.*, 2017). Presenting accurate information for fashion products prevents unnecessary returns (de Leeuw *et al.*, 2016). Although better product information may not increase sales, consumers will be more satisfied with their purchase and less likely to return the products (Jai *et al.*, 2021). Additional presentation materials cost time and money, but an incorrect impression also leads to costs, as consumers may return the item. Investing in more accurate product presentation is thus advantageous for companies, consumers, and society.

Our research takes an important step by showing ways to promote accurate fabric impressions. Fabric is important in buying clothing (Boardman and McCormick, 2022), and the material not meeting expectations is one of the main reasons for fashion returns (Saarijarvi *et al.*, 2017). Our findings are relevant for retail education and practice. In fashion retail education, the focus should be shifted from tempting consumers to buy to conveying accurate information. Students should be made aware of the importance of accurate online fabric communication, and our research shows some ways to achieve this (further optimisation is the

next step). In addition, knowledge on how to convey specific fabric properties online is relevant in digital design education. Furthermore, public policy should promote sustainability in fashion e-commerce, and accurate fabric communication helps in this.

### 5.1 Theoretical implications

Our research contributes to the online retailing and fashion marketing literature. Although several studies have investigated the effect of online product presentation, increasing sales has been the main focus, and the effect on accurate product perception has been largely ignored. Our studies add knowledge on how to convey accurate fabric impressions online and which presentation method works best for which fabric properties.

The most beneficial effects were found for videos in which hands interact with fabric by shaking, stretching, and crunching it. This facilitated accurate online fabric communication (Studies 1 and 2), in line with [Orzechowski et al. \(2011\)](#) and [Wijntjes et al. \(2019\)](#), supporting H3. It specifically improved the perception accuracy of stiffness and stretchability (Study 2), which are handling properties that are indeed difficult to communicate in pictures ([Jang and Ha, 2021](#); [Soufflet et al., 2004](#)). Although motion helps perceive material surface shininess ([Doerschner et al., 2011](#); [Wendt et al., 2010](#)), these videos did not improve fabric glossiness perception (Study 1).

Scrunched fabric pictures improved the glossiness assessment of the slightly glossy dress (Study 1; glossiness was not included in Study 2), agreeing with [Xiao et al.'s \(2016\)](#) findings on draped fabric. Such pictures also improved thickness perception for another dress (Study 1), confirming that showing folds aids in assessing fabric thickness ([Jang and Ha, 2021, 2023](#)). However, these pictures worsened weight perception for the Lyocell dress (Study 1) and stiffness perception for another dress (Study 2), contradicting [Xiao et al. \(2016\)](#) and [Jang and Ha \(2021\)](#). Also, they did not impact stretchability perception, as [Jang and Ha \(2021\)](#) suggested. Thus, H1 was supported for some properties and rejected for others.

A video showing a moving model (with a neutral background and only showing the body) improved the glossiness assessment of the slightly glossy dress in Study 1 (not tested in Study 2), agreeing with [Doerschner et al. \(2011\)](#) and [Wendt et al. \(2010\)](#). Despite the overall positive effects found by [Xue et al. \(2016\)](#) and participants mentioning its helpfulness in assessing weight and thickness in [Jang and Ha's study \(2021\)](#), there were no other significant effects of the model video. Thus, only weak support was found for H2.

### 5.2 Managerial implications

Our research contributes knowledge on which online presentation methods promote accurate fabric impressions, and for which fabric properties. We focused on presentation methods that are currently feasible to implement in the practice of online retailing, providing actionable results.

A hands-interaction video was found to aid accurate fabric perception, especially for stiffness and stretchability. A model video showed less impact and only helped in conveying glossiness. Scrunched fabric pictures showed mixed results; they could help better convey fabric glossiness and thickness online, but care should be taken so that they do not worsen the perception of weight or stiffness. However, these methods may be further improved in order to increase their beneficial effects ([section 5.3](#)).

Additional ways of presenting fabric may not be needed for materials that consumers are familiar with and that are easy to perceive from pictures. However, some materials and properties may be difficult to perceive from conventional online presentation methods. Stretchability is especially difficult to communicate on-screen ([Jang and Ha, 2021](#)), so for stretchable fabrics, a hands-interaction video will be very useful. Also, consumers may have incorrect expectations for innovative materials they are unfamiliar with, such as new sustainable materials. In such cases, a hands-interaction video will help increase consumer

trust in having gained an accurate impression, which will increase acceptance and sales for unfamiliar materials that consumers are reluctant to buy online.

### 5.3 Limitations and further research

While many fabric properties can vary, we tested only five dresses. Stronger variation in specific properties, such as glossiness and transparency, also using different types of garments, will provide more detailed insight into how to convey specific fabric properties online.

Several variables, such as fashion knowledge, need for touch (NFT), gender, and maybe even culture, may influence the performance of specific presentation methods. Fabric presentation methods will be more beneficial for people with less fashion knowledge and experience with specific fabrics, and lower NFT. Females may have a higher NFT (e.g. [Rodrigues et al., 2017](#)) and more often buy fashion online (e.g. [Jai et al., 2021](#)), so the effects may differ for male participants. There may even be cultural differences in fabric perception ([Ishikawa et al., 2023](#)). Taking these variables into account will provide a more nuanced understanding of how and when additional presentation methods aid fabric perception accuracy.

Future research is needed to further optimise the tested presentation methods. A hands-interaction video may be improved by investigating which specific movements (e.g. scrunching, shaking, stretching) aid the perception of specific fabric properties. Also, it may be efficient for retailers to integrate a hands-interaction and a model video. Several retailers already include a model video to show how clothing fits on a body. The video could additionally zoom in on the model scrunching or stretching the fabric. Combining methods would be relevant for the online fashion retailing practice, as the quantity of information provided online should be restricted to avoid overwhelming consumers ([Silva et al., 2021](#)).

Scrunched fabric pictures may be improved by showing a hand scrunching the fabric in the picture. This provides more information on the size of the fabric, which probably helps interpret the scrunch effect to infer thickness and stiffness, and may lead to a better performance. Such pictures could be useful for clothing retailers, as they may be easier to construct than videos of hands interacting with the fabric.

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### Notes

1. A fifth condition, showing fabric property rating scales for the dresses, was excluded from the analysis. For some dresses/properties, these ratings (based on 10 people) differed from the mean real fabric ratings from Study 1, thus presenting incorrect information.
2. As there originally were five conditions (see [\[1\]](#)), each participant evaluated all five dresses, each dress being assessed in the same condition by 18 people ( $5 \times 18 = 90$ ).
3. “Colourfulness” was rated but excluded from analysis, as variations in colour perception could result from slight differences in lighting between pictures and videos, instead of the experimental conditions *per se*.
4. As sphericity could not be assumed for the dress and condition-dress interaction effects, the degrees of freedom were corrected using Huynh-Feldt estimates (in line with common statistical guidelines).

### Supplementary material

The supplementary material for this article can be found online.

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